

Claims

[1] Separation membrane comprises

a porous substrate which is made of ceramic sintered body of which a main ingredient is alumina, and

5 a zeolite membrane which is formed over the surface of the porous substrate,

wherein the porous substrate comprises a base layer and a foundation layer which is formed on the base layer and is formed for the zeolite membrane, and

10 wherein the separation membrane is characterized in that a mean pore diameter of the foundation layer is smaller than a mean pore diameter of the base layer.

[2] Separation membrane according to Claim 1, wherein a nitrogen gas permeation rate through the porous substrate 15 is in the range of $200 - 7000 \text{ m}^3/(\text{m}^2 \cdot \text{hr} \cdot \text{atm})$.

[3] Separation membrane according to Claim 2, wherein the nitrogen gas permeation rate is in the range of $400 - 7000 \text{ m}^3/(\text{m}^2 \cdot \text{hr} \cdot \text{atm})$.

[4] Separation membrane according to one of Claims 1 to 20 3, wherein the mean pore diameter of the base layer is in the range of $4 - 12 \mu\text{m}$, and the mean pore diameter of the foundation layer is in the range of $0.4 - 1.2 \mu\text{m}$.

[5] Separation membrane according to one of Claims 1 to 25 4, wherein thickness of the base layer is in the range of $1 - 3 \text{ mm}$.

[6] Separation membrane according to one of Claims 1 to 5, wherein thickness of the foundation layer is in the range

of 10 - 200 μm .

[7] Separation membrane according to one of Claims 1 to 6, wherein aspect ratio of particles of which the foundation layer is comprised is not less than 1.05.

5 [8] Separation membrane according to Claim 7, wherein the aspect ratio of particles of which the foundation layer is comprised is not less than 1.2.

10 [9] Separation membrane according to one of Claims 1 to 8, wherein porosity of the porous substrate is in the range of 20 - 50%.

[10] Separation membrane according to Claim 9, wherein the porosity of the porous substrate is in the range of 35 - 40 %.

15 [11] Separation membrane according to one of Claims 1 to 10, wherein the porous substrate has a maximum pore diameter of not more than 9 μm , the maximum pore diameter being determined by the bubble point method using water.

20 [12] Separation membrane according to one of Claims 1 to 10, wherein the porous substrate has a maximum pore diameter of not more than 7 μm , the maximum pore diameter being determined by the bubble point method using water.

[13] Separation membrane according to one of Claims 1 to 12, wherein a total content of Ca and K included in the porous substrate is not more than 0.8 mol%.

25 [14] Separation membrane according to one of Claims 1 to 12, wherein the total content of Ca and K is not more than 0.5 mol%.